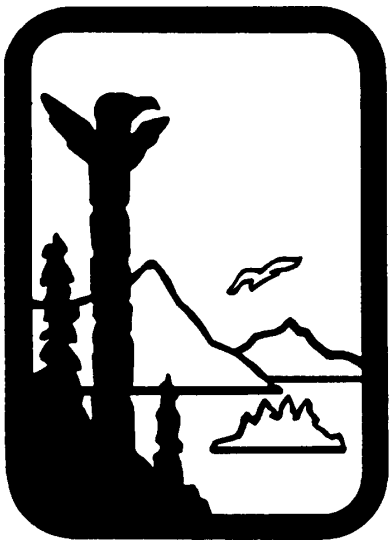
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

DIVISION OF ENVIRONMENTAL HEALTH
DRINKING WATER AND DOMESTIC WASTEWATER PROGRAM



INSTALLER'S MANUAL
FOR CONVENTIONAL ONSITE DOMESTIC WASTEWATER TREATMENT AND DISPOSAL SYSTEMS

August 1, 2000

Tony Knowles
Governor

Michele Brown
Commissioner

This document contains information regarding the installation of onsite sewer systems for single-family and duplex residences. It must be used by Certified Installers and homeowners who are subject to 18 AAC 72. Additional requirements are included in 18 AAC 72. If there is a conflict between the provisions of this manual and 18 AAC 72, 18 AAC 80, or other state regulations, the regulations language controls.

ADEC OFFICES

Anchorage (covers all of Southcentral and Southwestern Alaska except as otherwise noted)
555 Cordova
Anchorage, AK 99501
(907) 269-7500
Certified Installer Line (907) 269-7517

Fairbanks (covers all of Northern Alaska)
610 University Avenue
Fairbanks, AK 99709
(907) 451-2109

Kenai Peninsula (also covers Kodiak)
43335 Kalifornsky Beach Road, Suite 11
Soldotna, AK 99669
(907) 262-5210 extension 252

Ketchikan (covers Southern Southeast)
540 Water Street, Suite 203
Ketchikan,AK 99901
(907) 225-6200

Mat-Su Valley (also covers Valdez)
P.O. Box 871064
Wasilla, AK 99687
(907) 376-5038
Certified Installer Line (907) 376-5139

Juneau (also covers Sitka and Northern Southeast)
410 Willoughby Avenue
Juneau, AK 99801
(907) 465-5350

TABLE OF CONTENTS

List of Figures

List of Tables

I. INTRODUCTION

An estimated 30% to 40% of Alaskans rely on some sort of onsite system to treat and dispose of domestic wastewater. Assuring that these systems meet minimum design and construction standards so that they will adequately treat wastewater prior to disposal into groundwater, is a critical public health issue. Many diseases, such as dysentery, infectious hepatitis, typhoid and paratyphoid, and various types of diarrhea can be transmitted from person to person through contact with or exposure to improperly treated human waste. Systems that have failed, are poorly sited, or improperly constructed or maintained, may provide a vehicle for human exposure to these unnecessary health risks.

This manual provides system installers with the background needed to understand the principles required for the proper design and construction of conventional onsite wastewater systems under conditions typically found in Alaska.

This manual includes specific information on:

- proper siting of systems,
- examining soil and groundwater conditions,
- system design selection,
- separation distance requirements,
- proper construction materials,
- installation criteria, and
- record keeping documentation.

This manual is based on Alaska Administrative Codes (AAC) Wastewater Treatment and Disposal regulations (18 AAC 72) and Drinking Water regulations (18 AAC 80) that are in effect as of the date of this manual. The regulations are available from any ADEC Office or on the Internet at http://www.state.ak.us/dec/deh/water/ci.htm.

II. PURPOSE

The purpose of this manual is to help Certified Installers and Approved Homeowners design and construct conventional, onsite domestic wastewater treatment and disposal systems serving single family and duplex residences and small commercial systems with design flows not exceeding 500 gallons per day, that will provide:

- adequate treatment of wastewater prior to disposal to the groundwater system;
- economical and long-lasting service to the owner; and
- assurance that the constructed onsite system will comply with the wastewater treatment and disposal regulations in 18 AAC 72;

A conventional onsite system is defined in 18 AAC 72.990 as a system treating domestic wastewater that meets the requirements of 18 AAC 72.035 and 18 AAC 72.260 and that uses a septic tank followed by a discharge into a conventional soil absorption system in undisturbed native soil, with or without a sand liner. It includes a properly pressurized sewer line used to convey sewage from the home into a septic tank or from a septic tank into a gravity distribution soil absorption system, but does not include an intermittent sand filter design or elevated mound system design.

III. RESTRICTION ON WHO MAY INSTALL ONSITE SYSTEMS.

18 AAC 72.015 restricts who may install onsite wastewater systems to:

- Registered engineers,
- Certified installers[1],
- Approved homeowners[1], and
- Contractors or individuals who have their work inspected by a registered engineer.

Certified Installers, without prior plan approval, may install conventional onsite systems serving single family or duplex residences and systems serving a single commercial building having a maximum wastewater flow of 500 gallons per day or less.

Approved Homeowners are restricted to installing conventional systems that serve their own single family residence or an owner occupied duplex. Approved Homeowners may not install a commercial system without ADEC plan approval and the oversight of a registered engineer.

IV. NOTIFICATION AND DOCUMENTATION OF CONSTRUCTION.

A. Notification.

18 AAC 72.435 requires that Certified Installers and Approved Homeowners notify the nearest ADEC office at least 24 hours in advance of beginning construction/installation of a system. In this context, beginning construction means the time when excavation for a system will begin with the intent to continuously proceed toward completing the installation. Notification provides ADEC with the opportunity to inspect the system. However, inspections are not required, therefore an installer who properly notifies ADEC, should proceed with the work, and not wait for ADEC to inspect.

Installers should call their local office, or the office nearest the installation using the office listing and telephone numbers provided at the front of this manual, and provide the following information:

- The legal description and location of the property and accurate directions to the site.

- The installer's name, installer's certification number, phone number, and if applicable, the contractor's name and license number.

- The scheduled date when the installation or modification will begin.

Current regulations also allow "emergency" notification for times when the 24-hour prior notice is not possible. This provision is for times when, through no fault of the installer, the construction timeframe for a system must be moved ahead or for a system that requires immediate repair or reconstruction. Notice must be provided to the department as soon as possible, and in any case, before the installation or modification begins.

[1] For information on becoming a Certified Installer or an Approved Homeowner, see 18 AAC 72.400 – 18 AAC 72.440.

B. Documentation of System Construction.

18 AAC 72.010(c) requires that the installer of a conventional onsite domestic wastewater disposal system submit documentation of system construction within 90 days after construction has been completed. This information should be submitted on the "Documentation of Construction" form available from the Department. This requirement applies to systems installed by Certified Installers, Approved Homeowners and those installations inspected by a registered engineer.

For systems installed under the inspection of a registered engineer, the Documentation of Construction form must be fully completed and sealed and signed by the registered engineer responsible for providing the inspection. Pictures of the installation are not required if the information is submitted under the seal and signature of an engineer.

For systems installed by Certified Installers and Approved Homeowners, the following additional information must be provided:

At least four photographs of the installation with the following views:

- septic tank with inlet or outlet exposed and gallonage label showing;
- open excavation of absorption field and line leading to it;
- filter fabric pulled back to reveal screened gravel and perforated pipe in absorption field; and
- finished grading and landscaping with standpipes.
- If applicable, installers shall also photograph the sand liner excavation and the in-place sand. These photographs must be submitted with the documentation of construction form.

All other pertinent information such as an asbuilt survey if one is available or required by a financial institution, a well log (if available), testhole and perc test results if required, septic tank pumping receipt if applicable, sand liner approvals if applicable, and any other information important to an accurate description of the system. A sketch of the installed system meeting the Instructions for Diagram on the Documentation of Construction form must also be provided.

V. ADEC PLAN APPROVAL REQUIREMENTS

Conventional onsite systems that serve a single-family home, a duplex dwelling, and a small commercial facility are exempt from plan approval requirements. Note that these systems are exempt only from the plan submittal/approval requirements, not from any of the other requirements of this manual or the Wastewater Treatment and Disposal regulations.

Proprietary products, such as *SB2* (gravel-less pipe) and *Infiltrators* may be installed without plan approval if:

- For 8" diameter *SB2* gravel-less pipe, a maximum of 1.5 square feet of absorption area per running foot of pipe is used for system design. For 10" diameter *SB2* pipe, a maximum of 2.0 square feet of absorption area per running foot of pipe is used for system design.

- For *Infiltrators,* only the bottom area may be used for sizing the absorption area, without any increase allowed for reducing potential soil masking.

- With the exception of the sizing limitations identified above and other provision of this manual and 18 AAC 72, these products must be installed in accordance with the manufacturer's directions. Any deviation, or requests for increased application rates, requires ADEC plan approval.

The following situations require plans to be submitted to ADEC by a registered engineer and approved prior to construction, regardless of system size:

- Waiver request for reduction of required separation distances.
- Surface discharge proposals.
- Poor soils (soils with a percolation rate slower than 60 minutes per inch.)
- Mound absorption bed designs. A mound is a system constructed on fill material where the base of the sewer rock is above the natural ground surface.
- Sewage lift stations (except pre-approved designs such as Anchorage Tank [ORENCO], Greer Tank).
- Package treatment plants.
- Other non-conventional or alternative onsite wastewater system proposals.
- Holding tanks.
- Conventional systems serving (i) dwellings bigger than a duplex, or (ii) commercial, business, church, trailer park, or similar facilities with an expected peak design flow greater than 500 GPD, must have written department approval as provided in 18 AAC 72.210 - 18 AAC 72.285.

Installers will occasionally be confronted with individuals who want a public water system constructed. Please note that all public water systems require ADEC approval of engineered plans prior to construction. Before proceeding, always make sure that ADEC has approved the system's plans.

VI. ESTIMATING WASTEWATER QUANTITIES

Typical residential water usage is approximately 75 gallon per day per person. This includes water used for bathing, laundry, toilet and other miscellaneous uses. Because good design requires that systems be able to accommodate the maximum expected flow, ADEC has set 150 gallons per day per bedroom (two people per bedroom) as the minimum design standard for estimating residential wastewater flows. Designers and installers should never reduce wastewater design flow estimates or system size because of circumstances that may be temporary, such as two people living in a three-bedroom home.

Estimating wastewater flows from commercial facilities is more difficult than for residential situations. The values shown in the following tables have been taken from the "Onsite Wastewater Treatment and Disposal Systems Design Manual" published by the EPA in 1980. Note that in several cases, wastewater estimates are divided between the number of patrons and the number of employees, with each category generating a different amount of wastewater per person per day. The daily wastewater flow used for sizing a system must include all sources.

TABLE 1 - WASTEWATER FLOWS FROM COMMERCIAL SOURCES

SOURCE	UNIT	WASTE WATER FLOW RANGE IN GAL PER DAY PER UNIT	TYPICAL FLOW IN GAL PER DAY PER UNIT
AIRPORT	PASSENGER	2.1 TO 4.0	2.6
AUTO SERVICE STATION	VEHICLE	7.9 TO 13.2	10.6
BAR	CUSTOMER	1.3 TO 5.3	2.1
	EMPLOYEE	10.6 TO 15.8	13.2
HOTEL	GUEST	39.6 TO 58	50.1
	EMPLOYEE	7.9 TO 13.2	10.6
INDUSTRIAL BUILDING, EXCLUDING INDUSTRY AND CAFETERIA	EMPLOYEE	7.9 TO 17.2	14.5
LAUNDRY – SELF SERVE	MACHINE	475 TO 686	580
	WASH	47.5 TO 52.8	50.1
MOTEL	PERSON	23.8 TO 39.6	31.7
MOTEL WITH KITCHEN	PERSON	50.2 TO 58.1	52.8
OFFICE	EMPLOYEE	7.9 TO 17.2	14.5
RESTAURANT	MEAL	2.1 TO 4	2.6
ROOMING HOUSE	RESIDENT	23.8 TO 50.1	39.6
STORE, DEPARTMENT	TOILET ROOM	423 TO 634	528
	EMPLOYEE	7.9 TO 13.2	10.6
SHOPPING CENTER	PARKING SPACE	0.5 TO 2.1	1.1
	EMPLOYEE	7.9 TO 13.2	10.6

It should be noted that while the above categories are fairly specific and the typical flow estimated is quite precise, good judgment must be exercised when using these estimates. In most cases, the typical value should be used for design, unless the design is engineered, but in some cases the upper range value should be used if excessive water usage patterns are evident. The lesser range value should not be used unless the system is engineered. As in residential wastewater estimates, all wastewater sources should be considered, including water from treatment processes such as softener backflushing or reverse osmosis units.

Even though Certified Installers will usually not design systems that serve institutional facilities, the estimated wastewater flows shown in Table 2 are provided for informational purposes so that installers can compare usage in other applications.

TABLE 2 - WASTEWATER FLOWS FROM INSTITUTIONAL SOURCES.

SOURCE	UNIT	WASTEWATER FLOW RANGE IN GAL PER DAY PER UNIT	TYPICAL FLOW IN GAL PER DAY PER UNIT
HOSPITAL, MEDICAL	BED	132 TO 251	172
	EMPLOYEE	5.3 TO 15.9	10.6
HOSPITAL, MENTAL	BED	79.3 TO 172	106
	EMPLOYEE	5.3 TO 15.9	10.6
PRISON	INMATE	79.3 TO 159	119
	EMPLOYEE	5.3 TO 15.9	10.6
REST HOME	RESIDENT	52.8 TO 119	92.5
	EMPLOYEE	5.3 TO 15.9	10.6
SCHOOL, DAY, WITH CAFETERIA, GYM AND SHOWERS	STUDENT	15.9 TO 30.4	21.1
SCHOOL, DAY, WITH CAFETERIA ONLY	STUDENT	10.6 TO 21.1	15.9
SCHOOL DAY, WITHOUT CAFETERIA, GYM OR SHOWERS	STUDENT	5.3 TO 17.2	10.6
SCHOOL, BOARDING	STUDENT	52.8 TO 106	74

Certified Installers may become involved in some onsite wastewater treatment and disposal systems that serve small recreational facilities. In addition to conventional onsite systems serving single family and duplex dwellings, Certified Installers may construct conventional onsite systems for a single commercial building or facility that has an expected wastewater design flow rate of 500 gallons per day or less. If there is any uncertainty in determining a design wastewater flow for a system, the Certified Installer should call the local ADEC office for assistance. Note that all community and/or collection systems such as those serving two or more separate dwellings or an R/V collection, treatment, and disposal systems, must be engineered and receive ADEC plan approval prior to construction.

TABLE 3 - WASTEWATER FLOWS FROM RECREATIONAL SOURCES.

SOURCE	UNIT	WASTEWATER FLOW RANGE IN GAL PER DAY PER UNIT	TYPICAL FLOW IN GAL PER DAY PER UNIT (GPD)
APARTMENT, RESORT	PERSON	52.8 TO 74	58.1
CABIN, RESORT	PERSON	34.3 TO 50.2	42.3
CAFETERIA	CUSTOMER	1.1 TO 2.6	1.6
	EMPLOYEE	7.9 TO 13.2	10.6
CAMPGROUND, DEVELOPED	PERSON	21.1 TO 39.6	31.7
COCKTAIL LOUNGE	SEAT	13.2 TO 26.4	19.8
COFFEE SHOP	CUSTOMER	4.0 TO 7.9	5.3
	EMPLOYEE	7.9 TO 13.2	10.6
COUNTRY CLUB	MEMBER PRESENT	66 TO 132	106
	EMPLOYEE	10.6 TO 15.9	13.2
DAY CAMP	PERSON	10.6 TO 15.9	13.2
DINING HALL	MEAL SERVED	4.0 TO 13.2	7.9
DORMATORY/BUNKHOUSE	PERSON	19.8 TO 46.2	39.6
HOTEL, RESORT	CUSTOMER	39.6 TO 63.4	52.8
LAUNDROMAT	WASH MACHINE	476 TO 687	581
RECREATIONAL VEHICLE PARK WITH SEWER/WATER HOOKUPS	R/V SPACE	75 TO 125	100
STORE, RESORT	CUSTOMER	1.3 TO 5.3	2.6
	EMPLOYEE	7.9 TO 13.2	10.6
THEATER	SEAT	2.6 TO 4	2.6
VISITOR CENTER	VISITOR	4 TO 7.9	5.3

Wastewater estimating methods contained in Appendix K of the Uniform Plumbing Code may also be used for determining wastewater design flows. It is extremely important that wastewater design flows not be under estimated. Failure to account for expected flows will contribute to premature failure of the absorption system.

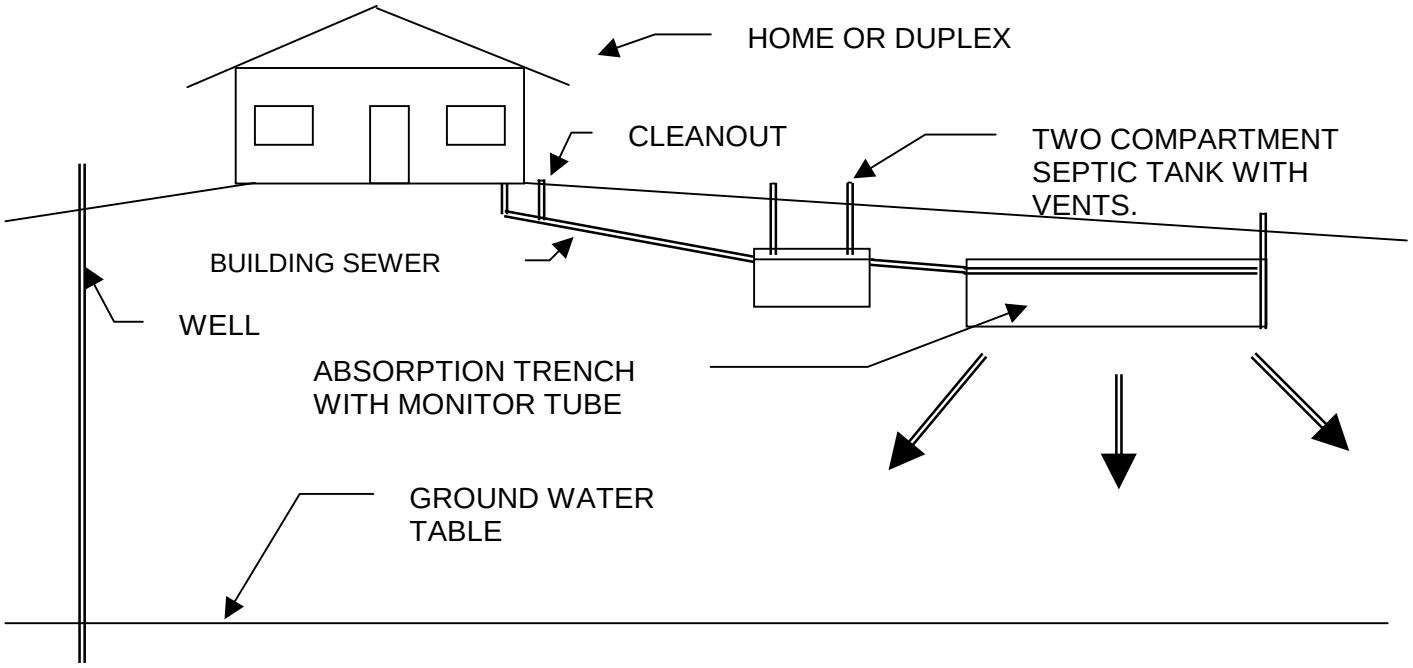
Systems with seasonal flows such as most campgrounds or R/V parks, must be designed based on full occupancy. No reduction in drain field size or reduction in septic tank size is allowed for seasonal uses since they need to handle the daily maximum wastewater flow.

VII. WASTEWATER TREATMENT AND DISPOSAL.

A. Elements of the Onsite Wastewater System

The typical onsite wastewater system consists of two essential treatment elements, the pretreatment unit (septic tank) and the soil absorption system. A typical septic system is shown in Figure 1.

Figure 1. Typical Onsite System



The building sewer connects the building drain to the septic tank. The septic tank separates floating and settling materials from the liquid portion of the wastewater. Clarified effluent is then passed on from the septic tank to the soil absorption area for final treatment and disposal. The absorption area consists of a buried excavation filled with a porous medium, usually specially graded, clean, sewer rock and a piping system within the rock, that distributes wastewater throughout the system. The primary purpose of the sewer rock is to help laterally distribute the wastewater and to provide a storage area for wastewater in the pore space.

Under most conditions, soil is very effective in treating domestic wastewater by reducing total suspended solids (SS), biochemical oxygen demand (BOD) and bacteria, prior to discharge to the ground water. Septic tanks and absorption systems are not effective in removing dissolved substances such as solvents, petroleum products, pesticides, or other chemicals. These substances should never be dumped into a septic system because little, if any, treatment will occur and the ground or ground water could become contaminated.

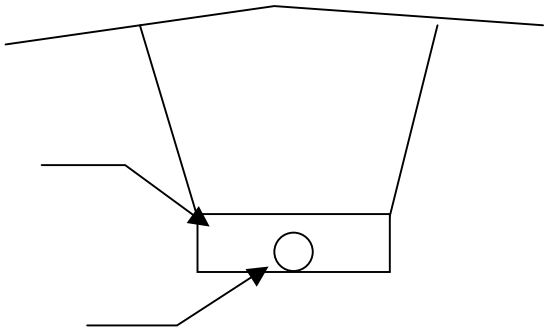
B. Building Sewer

The building sewer is the horizontal pipe that extends from the building drain, to the onsite sewer system (septic tank and absorption area). The minimum building sewer line size is four inches to reduce the potential for plugging. The slope or grade of the building sewer should be as uniform as possible, ranging between 2% and 10% (2 to 10 feet of drop per 100 horizontal feet of pipe), except that the 10 feet immediately preceding the septic tank may not exceed 2% slope. Maintaining these pipe slopes assures an adequate cleansing velocity in the building sewer. Reducing the slope immediately before the septic tank moderates the entrance velocity of the wastewater into the tank, and minimizes the turbulence in the tank.

The building sewer should be laid on undisturbed or compacted soil, it must be properly bedded

to prevent relative low points in the line where water and solids can accumulate and may freeze or otherwise block the pipe. Soil in the pipe zone must also be properly compacted to prevent excessive deflection or even pipe collapse because of soil pressure from backfill. Areas that are overexcavated, such as at the septic tank ends, should be carefully compacted to adequately support the piping yet protect the septic tank from deflection.

Figure 2 Pipe bedding.

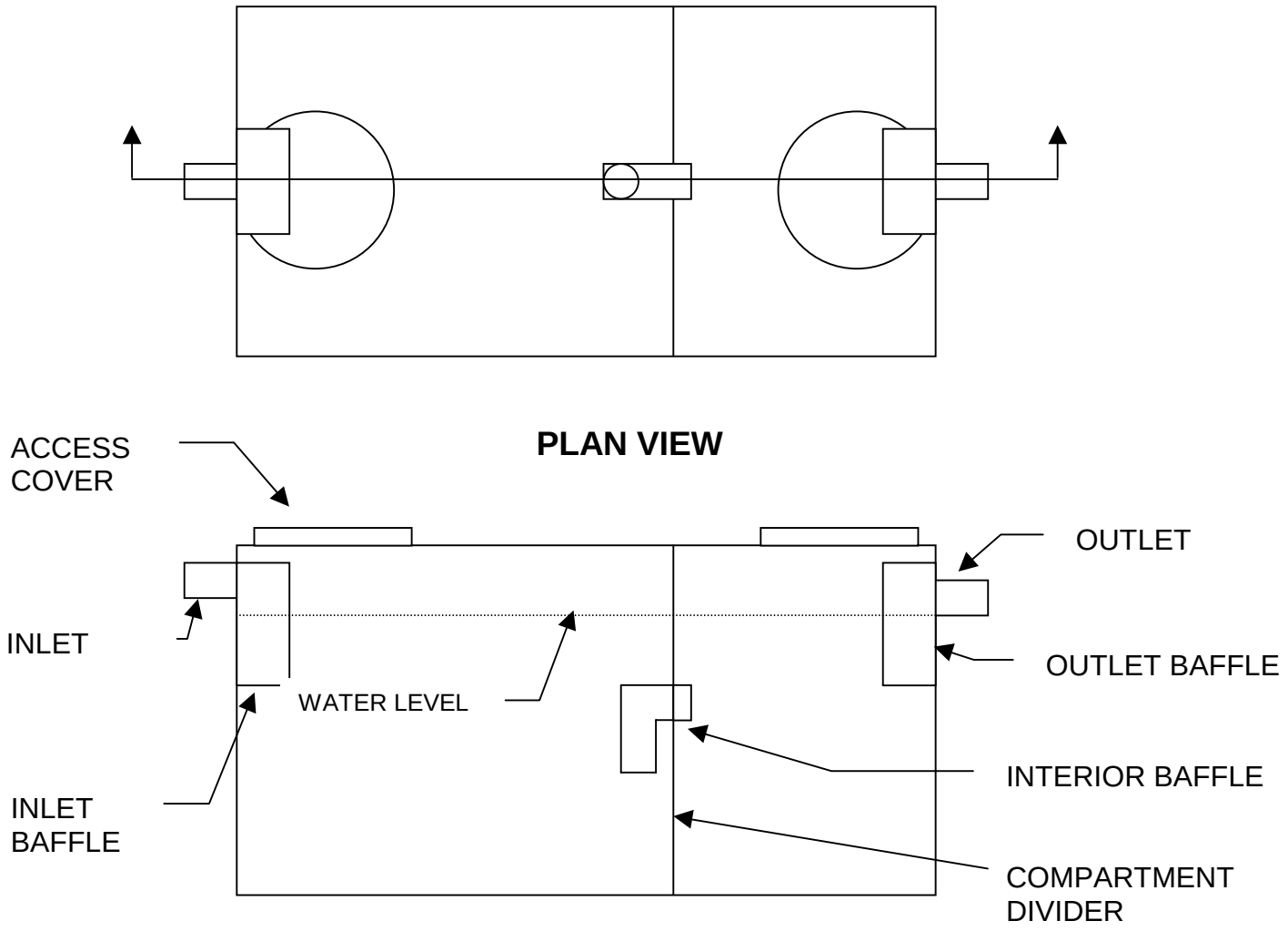


VIII. SEPTIC TANKS.

Septic tanks separate solid material from liquid by providing time for heavier materials to settle to the tank bottom forming a sludge layer, and for lighter materials to float to the top forming a scum layer. These layers may later be reduced in volume by anaerobic digestion, which is the decomposition of organic and inorganic matter in the absence of oxygen. Septic tanks do not completely purify wastewater, eliminate odors, or digest all solid material, but they are effective in trapping most solids and grease so that reasonably clear wastewater is passed on to the absorption field. Improperly designed or damaged tanks, or designs that cause turbulence in the septic tank, can allow solid material to migrate out to the absorption area which usually produces premature failure.

A typical two-compartment septic tank is shown in Figure 3. The two-compartment design has been shown in some studies to exhibit a slightly better removal of suspended solids than single compartment tanks. Regulations require that two compartment tanks be used.

Figure 3. Typical Two-Compartment Septic Tank



Baffles are located at the inlet, compartment divider and outlet of a septic tank. The inlet baffle is designed to slow down the incoming wastewater and direct it downward. The interior baffle keeps most of the solid material in the first compartment and the outlet baffle retains the lightweight floating material, such as grease and wax, within the tank, keeping it out of the soil absorption field. A built-in vertical drop of approximately three inches between the inlet and outlet pipe is common. During installation, if the inlet and outlet ends of the septic tank are reversed, water will back up into the building sewer, stranding solids that could block the line.

Adequate storage volume for accumulated sludge and scum, must be designed into the septic tank to provide a reasonable time between tank pumping. Current state regulations (18 AAC 72) requires at least a 1000 gallon tank for a residence with three bedrooms or less and an additional capacity of 250 gallons for each bedroom in excess of three. If a septic tank incorporates an integral lift station pumping chamber, the required tank size must be increased by 250 gallons. In warmer climates, the volume of the sludge is reduced through anaerobic digestion, thus helping extend the time interval between septic tank pumpings. Alaskan climates typically result in septic tank temperatures in the 40-60^{o} F range, where little or no anaerobic digestion takes place so settled material and scum accumulates faster than it would in the more temperate climates. Table 4 summarizes the requirements for residential use septic tank size.

TABLE 4.
SINGLE-FAMILY RESIDENTIAL SEPTIC TANK SIZE REQUIREMENTS

No. of Bedrooms	Liquid Capacity
1-3	1,000
4	1,250
5	1,500
6	1,750
7	2,000
8	2,250

Note:
- Over eight bedrooms, contact ADEC for septic tank sizes.
- If a garbage grinder is used, an additional 250 gallon capacity is recommended above the minimum bedroom size, to contain the extra sludge generated.
- When an integral lift station is contained in the tank, an additional 250 gallons is required to compensate for the loss in volume due to the pumping chamber.

Septic tank sizing for commercial facilities is based on peak estimated design flows, which may be estimated from Tables 1 – 3 of this manual. In general, for flows up to 1,500 gallons per day, 1.5 to 2 times the average daily flow is recommended, with a 1,000 gallon minimum tank size, regardless of design flows.

Materials that degrade slowly, such as coffee grounds, oil and grease, paper towels, disposable diapers, feminine hygiene products and similar materials should not be disposed of in septic tanks. Water softener wastes do not appear to be detrimental to the system, even if significant amounts of clay are present in the soil. They do, however, add a significant hydraulic load to the system and may contribute to the corrosion of steel septic tanks, which must be considered in the design. Household cleaning chemicals and detergents, in quantities normally used, are generally not harmful to the system.

Performance additives, such as yeast and enzymes, have not been found to be beneficial to the septic tank performance, particularly in cold climates.

Septic tanks should be pumped when the sludge layer or floating scum layer exceeds 6 inches. The sludge and scum layer may be checked by using a clear plastic pipe with a foot valve. This pipe is dipped down into the tank and upon removal visually shows sludge and scum depths. Because most people do not check their septic tank this way, **a two-year pumping cycle is recommended.** If septic tanks are not pumped periodically, accumulated sludge will overflow with the wastewater into the soil absorption field, resulting in premature failure of the field. **The single most important maintenance item a homeowner can do is to pump a septic tank every two years.**

Tanks should be located so that a pump truck can readily access the tank and in areas away from driveways or parking lots where snow is typically removed during winter months. The tank must also be constructed so that cleanout pipes can be attached to the tank. Cleanout pipes must be at least four inches in diameter to accommodate a pumping hose, and should extend above grade and the tops capped. Cleanout locations should be "tied" to permanent landmarks by measuring and recording the distance between the cleanout pipes and permanent features such as house corners, so that the pipes may be found if covered with snow or soil.

Septic tanks must meet the requirements of Appendix K of the Uniform Plumbing Code for tank design, materials and construction. Some alternate materials such as fiberglass or plastic have been accepted in the past. Home-built septic tanks should be avoided unless tanks are built according to approved designs. Prior to use of any unproven, unapproved or alternate material, installers must check with their local ADEC office to verify that the proposed product is acceptable. In all cases, installation recommendations or requirements of the manufacturer must be followed, except when modified by this manual. Limitations on the depth of burial imposed by the tank manufacturer must be followed. Where the required depth of cover (18 AAC 72.035) cannot be provided because of manufacturer limitations on depth of burial, the tank must be insulated.

IX. SOIL ABSORPTION SYSTEMS.

The soil absorption area or field is used as the final treatment and disposal point for the clarified effluent from the septic tank. Physical, chemical, and biological processes occurring within the soil will reduce the organic and microbial constituents of the wastewater. Three to five feet of unsaturated soil under the soil absorption field is required to effectively reduce the bacteria to an acceptable level. Current regulation requires at least 4 feet of vertical separation between the bottom most portion of the soil absorption system and the groundwater table measured during the time of year when it is expected to be the highest.

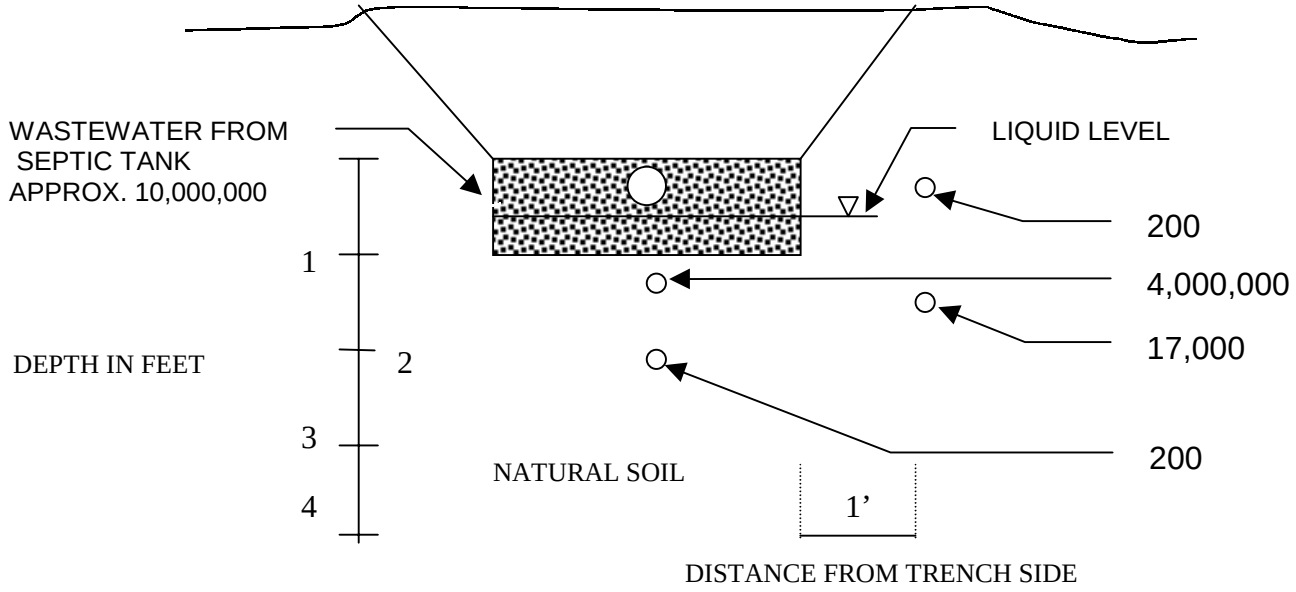
The most important consideration in design construction and operation of an onsite system, is assuring adequate wastewater treatment prior to disposal to the ground water system. Other important considerations include designing an efficient treatment system that incorporates long life, simple maintenance and proper sizing, and meets all required separation distances.

Once an absorption system is put into operation, a clogging mat or zone forms at the infiltrative surface, which slows the movement of water into soil. Many factors, some of which can be prevented by taking proper precautions during construction, contribute to the development of a clogging mat. Compaction of the receiving soil and smearing of the infiltrative surface are probably the two most significant errors made during construction that leads to the development of the clogging mat.

Construction machinery should not be driven over the infiltrative area. Beds and trenches should be excavated using a backhoe or similar apparatus, not using a dozer. If during the excavation process, the infiltrative surface becomes smeared, the surface should be raked or otherwise roughened, to remove the smeared soils. To overcome the smearing that naturally occurs when a backhoe bucket is drawn through soil, some contractors have installed rakes on the side of their buckets.

Figure 4 shows the reduction in fecal coliform bacteria under a typical absorption system.

Figure 4. Absorption Field Cross Section



Above numbers in organisms per 100 ml

A. Soil Absorption Design

Soil absorption systems must be designed based on site specific information as well as the quantity of wastewater to be treated. Required site information consists of:

- Subsurface soil conditions and percolation rate(s) of the receiving soil.
- Depth to the seasonal high groundwater table.
- Location of topographical features such as steep slopes, gullies, surface water and existing nearby sewer systems.
- Location of all nearby drinking water wells and determining the well classification, whether public or private.
- Location of permafrost or impermeable soil or bedrock.
- Lot layout and any limiting plat notes that may affect the type of onsite system allowed.

B. Siting

For new construction, the location of the onsite system should always be determined first before siting the well or constructing other improvements.

1. Preliminary assessment.

A preliminary assessment should be performed that consists of collecting all available information concerning the site and the surrounding area including the location of any public or individual drinking water wells. Sources of information may be the local ADEC Office, the U.S. Department of Agriculture, Natural Resources Conservation Service, the State Division of Geological and Geophysical Surveys, aerial photos, local government offices, neighboring property owners and local well driller's logs. When replacing an existing system, the local ADEC office should be checked for record information on the existing system as well as any plat approval restrictions. In some cases, percolation tests may have already been performed on the specific area in question, and could be used if appropriate.

TABLE 5. SITE CHARACTERISTICS

	SITE RATINGS GOOD	SITE RATINGS MODERATE	SITE RATINGS POOR
Site Characteristics:			
Texture	----	----	Permafrost and compacted silts
Flooding	None (protected)	Rare	Common
*Depth to Bedrock	>11 ft.	7-11 ft.	<7 ft.
*Depth to Cemented Soil (Clay-Silt)	>11 ft.	7-11 ft.	<7 ft.
*Depth to Seasonal High Water Table	>9 ft.	7-9 ft.	<7 ft.
Permeability (Percolation Rate)	1-10 min/in	10-45 min/in	<1 min/in or >45 min/in
Slope	0-10%	10-20%	>20%
Soil Classification	**GW, ** GP, SW SP	GM & SM	ML & CL

* Depth from ground level.
** These soils require a sand liner, unless waived by the department.

A preliminary field evaluation should then be performed that consists of a site inspection to locate areas on the lot best suited for a soil absorption system. Features such as gullies, surface water, onsite and neighboring wells, and roads must be noted in relation to proposed soil absorption system location. Once the most suitable site for the system is determined, a test pit or boring is dug within 25 feet of the perimeter of the proposed soil absorption system, to confirm subsurface conditions. Table 5 identifies good, moderate and poor site characteristics.

The test pit or boring needs to extend to at least 6 feet below the bottom of the proposed soil absorption system, to verify that no impermeable soil layers are within 6 vertical feet of the proposed bottom of the distribution rock. Data to be collected from the explorations include an estimate of soil texture or classification, soil structure, soil density, groundwater depth, location of any impermeable layers, and soil moisture conditions.

During the preliminary evaluation phase, a designer should be able to determine the type of system that may be required and whether ADEC plan approval is required. The installer should always look for the best possible site conditions when locating an onsite system.

2. Evaluating surface conditions.

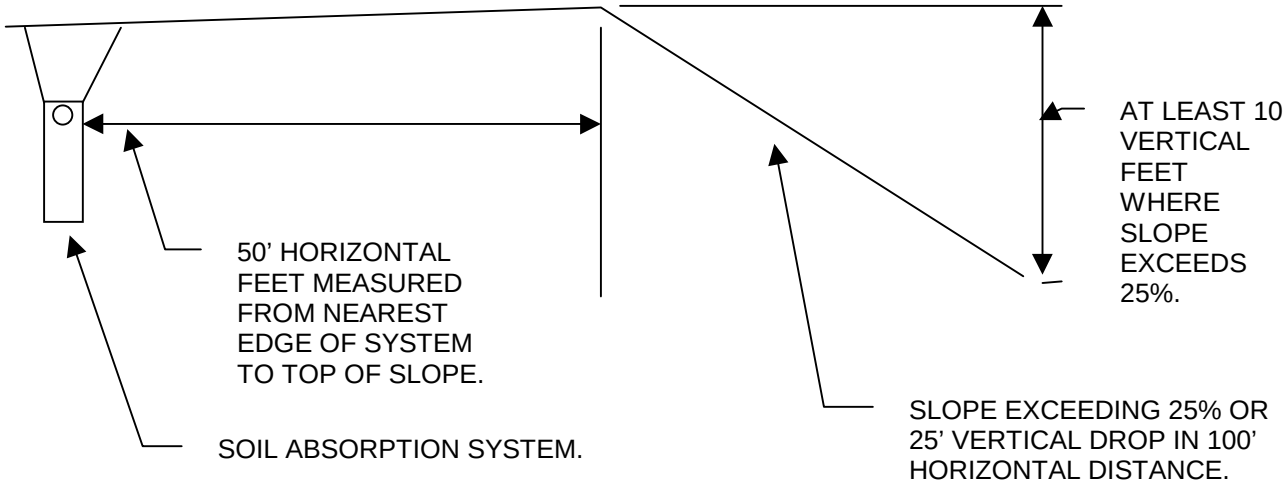
In many cases topographic features limit where an on-site wastewater treatment and disposal system may be located. When evaluating a site, one of the first things that should be done is to locate all surface features that will limit the location of an on-site system as follows:

- Drinking water wells. All drinking water wells in the vicinity of the system should be located. This includes wells on the property itself and on adjacent properties. Current regulations require a minimum separation distance of 200 feet to Class A and B public drinking water wells. Table 6 summarizes the minimum separation distances to wells and also provides a current definition of the various drinking water well classifications. If the proposed onsite wastewater system is within 200 feet of any well, the classification of that well must be known before proceeding. ADEC files may contain information on well locations and classification. If in doubt about a well class, do not proceed until the classification and the required separation distances are known.

- Surface water. Current regulations prohibit installing a lift station, holding tank, septic tank, soil absorption system, seepage pit, pit privy or other waste water collection, treatment, or disposal system within 100 feet measured horizontally, of the mean annual high water level of a lake, river, stream, spring or slough or the mean higher high water level of coastal waters. Note that this includes a slough which is further defined as a swamp, bog or marsh, especially one that is part of an inlet or backwater.

- Slope and cut banks. Current regulations require a 50 feet set back between the nearest edge of a soil absorption area and a slope exceeding 25% that has more than 10’ of elevation change. See figure 5 below.

Figure 5. Horizontal separation distance to a slope.



- Other wastewater systems. Regulations do not require a minimum separation distance between adjacent onsite wastewater systems. However, when possible, systems should be horizontally separated from one another by at least two times the effective depth of the system or six feet, which ever is larger.

- Other components of onsite wastewater systems such as private sewer lines, community sewer lines, cleanouts and manholes on community sewer pipes, liftstations and similar appurtenances must be separated from drinking water wells by the distances shown in Table 6. Separation distances are measured from the nearest edge of the soil absorption system, seepage pit, septic tank, holding tank, or privy to a drinking water source or to surface water.

- Obstacles. Objects such as trees, boulders, gardens, or man-made structures may be located inside the area selected for the onsite sewer system. If the property owner does not want these items removed, the system can be redesigned or laid out to go around them. Typically, a shallow or deep trench design would be used in these cases. Including curves or angles in the system layout would have negligible effects on the system's performance.

TABLE 6. MINIMUM SEPARATION DISTANCES

WELL CLASSIFICATION AND ABBREVIATED DEFINITIONS (SEE 18 AAC 80 FOR COMPLETE DEFINITIONS):

Class 'A' public water system" means a public water system that (1) is expected to serve, year-round, at least 25 individuals, (2) is expected to serve, year-round, at least 15 residential service connections; or (3) regularly serves the same 25 or more individuals for at least six months of the year;

Class 'B' public water system means a public water system that is expected to serve, in the normal order of events, at least 25 individuals each day or 10 service connections for at least 60 days of the year, and is not a Class A public water system.

Class 'C' public water system means a public water system that is neither a Class A nor a Class B public water system.

Private Water System means a potable water system serving one single-family residence or duplex.

WELL TYPE	DISTANCE TO	PRIVATE* SEWER LINE	COMMUNITY ** SEWER LINE	COMMUNITY SEWER CLEANOUT	SEPTIC TANK	FUEL*** TANK	HOLDING TANK	ABSORPTION FIELD	PRIVATE SEWER CLEANOUT
'A'		100'	200'	200'	200'	100'	200'	200'	100'
'B'		100'	200'	200'	200'	100'	200'	200'	100'
'C'		75'	100'	150'	150'	75'	100'	150'	75'
Private		25'	75'	100'	100'	25'	75'	100'	25'
Waterline		10'	10'	10'	10'	10'	10'	10'	10'

* Carries wastewater from a single residence, commercial establishment, or industrial establishment to a community sewer line or wastewater treatment and disposal system.
** Carries wastewater from any combination of two or more residences, two or more commercial or industrial establishments to a wastewater treatment and disposal system.
*** Greater distances recommended

SEWER COMPONENTS	DISTANCE TO	RIVER, LAKE, STREAM, SPRING	LOT LINE †	FOUNDATION	ABSORPTION FIELD†	GROUND SURFACE (GROUND COVER)††	OTHER ABSORPTION FIELDS†	SEASONAL HIGH WATER TABLE	BEDROCK, CLAY	SLOPES >25%
Septic Tank		100'	10'	10'	10'	4'	10'	-	-	-
Absorption Field		100'	10'	10'	-	4'	2 x gravel depth or 6', whichever is greater	4'	6'	50'

† Recommended
†† Southwest AK (Kodiak and southwest of Chignik) = 2 feet; Southeast AK and Valdez = 3 feet; All remaining areas of the State = 4 feet. See 18 AAC 72.035, Table A

TABLE 7. WASTEWATER APPLICATION RATES FROM PERCOLATION TEST RESULTS		
Observed Percolation Rate [a] Minutes/inch	**Application Rate in gal/day/ft^2 for design flow less than or equal to 2,500 gal/day**	**Soil Rating ft^2/bedroom**
Faster than 1[b]	Not Suitable	---
1 – 5	1.2	125
6 – 15	0.8	190
16 – 30	0.6	250
31 – 60	0.45	335
61 – 120[c]	Not Suitable	---

[a] Percolation tests, when required, must be performed by, or under the direct supervision of, a registered engineer.

[b] Soils with percolation rates faster than 1 minute per inch require a sand liner or additional treatment. This requirement effectively calls for a minimum infiltrative area of 125 ft^2 per bedroom if a sand liner is used.

[c] Engineering plans and ADEC plan approval are required.

In the Fairbanks area, an exception is the Fairbanks Silt Loam, as classified by the Natural Resources Conservation Service, which can be considered as a silty sand (SM) in regards to sizing.

TABLE 8. SOIL TABLE FOR SOIL ABSORPTION FIELD SIZING

Soil Type (Unified Soil Classification)	Soil Description	Infiltrative Area ft per bedroom
* GW, Well Graded Gravels	50% or more of coarse fraction retained on No. 4 sieve; less than 5% of fine fraction passes No. 200 sieve. No Cast - No Ribbons - Wide range of particle sizes. (Coarse Gravel)	*
* GP, Poorly Graded Gravel	50% or more of coarse fraction retained on No.4 sieve; less than 5% of fine fraction passes No. 200 sieve; No Cast - No Ribbons - Particles predominantly one size. (Sandy Gravel)	*
SW, Well Graded Sands	More than 50% of coarse fraction passes No. 4 sieve; less than 5% of fine fraction passes No. 200 sieve; Poor Cast - No Ribbons - Wide range of particle sizes.	125
SP, Poorly Graded Sands	More than 50% of coarse fraction passes No. 4 sieve; less than 5% of fine fraction passes No. 200 sieve; Casts - No Ribbons – Ashtray or beach sand.	150
GM, Silty Gravel	Less than 50% of coarse fraction passes No. 4 sieve; more than 12% of fine fraction passes No. 200 sieve; Casts - No Ribbons - Muddy Gravel.	Need soil log And perc test**
SM, Silty Sand	More than 50% of coarse fraction passes No. 4 sieve; more than 12% of fine fraction passes No. 200 sieve; Casts - Slight Ribbons - Muddy Sand.	Need soil log And perc test**
CL/ML, Clay/Silt	When damp, soil smears when excavated. Dry clods are firm to hard and may be flour-like when pulverized. Casts - Ribbons - Sticky. REQUIRES SOIL LOG AND PERC TEST.	Engineering plans required

* Sand liners or additional treatment required. This requirement effectively calls for a minimum infiltrative area of 125 ft^2 per bedroom (Well Graded Sand). If a sand liner is used on these soils, a percolation test is not required. However, if a sand liner is not proposed, a percolation test is required to verify the percolation rate, and if faster than 1 min/inch, the system design would require a 2 foot thick sand liner beneath the sewer rock, or some means of additional treatment to be approved by ADEC.

** Soil log and percolation test are not required if the department has predetermined and specified the soil type and rating in an identified area.

If a percolation test is performed, the test must be performed by, or under the direct supervision of, a registered engineer.

NOTE: For soil types other than those listed above, an engineering report supporting their suitability and required sizing must be prepared.

3. Sizing the Absorption Field.

After selecting the most appropriate type of absorption system for a given site, the infiltrative surface is sized based on soil conditions. Recognizing soil conditions and accurately rating the absorption capacity of the soils is vital to the design of a good system. At least two prospective areas should be investigated.

When conditions are suitable, a deep trench system absorption system is recommended and should be used because they tend to out-perform other system types.

The perimeter of each proposed absorption area should be temporarily marked using stakes and string line. Every effort should be made to keep heavy equipment and vehicular traffic outside of the marked areas to prevent compaction effects on the soil absorption characteristics

Table 7 provides information on the proper soil ratings based on percolation test and soil classification. Table 8 provides specific information needed to field identify the various classifications of soil and the resulting recommended soil loading rate, in square feet of infiltrative area per bedroom. Soil types are defined by the Unified Soil Classification System. Table 7, Wastewater Application Rates From Percolation Test Results, presents the application rates and associated soil ratings, in square feet of infiltrative area per bedroom, from percolation test results. Soils classified as well graded gravel (GW), poorly graded gravel (GP), silty gravel (GM), well graded sand (SW), poorly graded sand (SP), and silty sand (SM) are considered suitable for soil absorption systems. Note that Certified Installers must have an engineer perform a percolation test in soils classified a silty sand (SM), silty gravel (GM), silts (ML) and clay (CL).

Soils classified as silts, clays, and peats are not considered suitable for soil absorption systems unless an engineering report indicates they are suitable on a site specific basis. They must be approved by ADEC.

In order to identify subsurface soil conditions, a testhole or pit should be dug, preferably using a backhoe because a larger excavation provides the best opportunity to examine soils. The testhole(s) should be dug around the perimeter of the actual system site, rather than within. The testhole, however, should be within 25 feet of the perimeter of the proposed soil absorption area site. Equipment should be kept off the proposed system site to prevent compaction of the soil.

An alternate method of determining subsurface conditions is by boring, either by machine or by hand. This method should only be attempted by more experienced soil testers. Borings may be placed inside the perimeter of the system.

If SM (silty sand), GM (silty gravel) or finer grained soils are encountered in the absorption zone, a percolation test must be performed by a registered engineer. The percolation test results are then used to size the system, based on the values indicated in Table 7. If more than one soil horizon or soil type is to be used in the absorption area, then more than one percolation test may be required to size the system. When using soil horizons with differing percolation rates, the system size should be averaged based on the amount of area in each soil horizon.

To size the absorption area:

- Determine the required size by multiplying the number of bedrooms in the household by the soil rating, as determined by percolation tests and Table 7. For a small commercial system, use Tables 1 through 3 of this manual to determine the quantity of wastewater to be treated and disposed of each day. To size the infiltrative surface, divide the total amount of wastewater by the recommended application rate shown in Table 7.

- If SM, GM, ML, or CL soils are encountered, the results of a percolation test must be used to size the system. The measured percolation rate should be compared to the values shown in Table 7 to determine the soil rating. If SW or SP soils are encountered the soil may be visually rated by certified installers or engineers. Size the required infiltrative surface by multiplying the soil rating by the number of bedrooms served. Note that approved homeowners must have their soil tested to size their system.

4. Sand Liners.

Sand liners are required, (unless formerly waived by the department pursuant to the requirements in 18 AAC 72.260, Table C) when well or poorly graded gravel (GW or GP) is found in the absorption area unless additional treatment will be provided and is approved by ADEC. In most cases, GP and GW soils have such rapid percolation that adequate treatment of the wastewater is not provided unless a 2' thick sand liner is installed to slow the rate at which the wastewater passes through the soil. The sand liner increases filtration effectiveness, and produces a much higher quality effluent. Sand liners should have a maximum wastewater application rate of 1.2 gal/ft^2/day (see Table 7). For single family applications and an assumed water usage of 150 gal/day/bedroom (EPA Onsite Manual), this would result in a requirement of 125 ft^2/bedroom, that is

$$\frac{150 \text{ gal/day/bedroom}}{1.2 \text{ gal/ft}^2 \text{/day}} = 125 \text{ ft}^2\text{/bedroom}$$

For sand filter systems, the sand must be from an approved source or shown to meet the requirements of 18 AAC 72, as specified below. To ensure quality control on absorption systems larger than 1000 ft^2, ADEC may require separate sieve analysis for every 1000 ft^2 (75 cubic yards) of sand liner installed. It is recommended that compaction be kept to a minimum to ensure infiltration of the wastewater into and through the sand liner.

Sand liners may be used only on a bed or shallow trench system unless special, previously approved methods are used.

Specifications for sand liner material is in the minimum materials specifications section of this manual.

- Based on the results of a percolation test for SM, GM, ML, and CL soils, or a visual rating for SP or SW soils, size the required infiltrative surface area by multiplying the soil rating times the number of bedrooms. The percolation test results or soil rating should be compared to Tables 7 and 8 of this manual, to obtain the maximum allowable application rate to the receiving soil. Dividing the quantity of wastewater determined above, by the maximum allowable application rate will result in the total number of square feet of absorption area required.

Perform the following calculations to determine the absorption area dimensions:

- For a deep trench: To determine the total trench length required, divide the required absorption area by (2 times the chosen effective depth of the trench). The factor "2" is used because the trench uses both side walls for absorption.

For example, a three bedroom single family residence with a soil rating of 150 square feet per bedroom and a chosen effective depth of five feet, the calculation would be: (3 bedrooms)(150 square feet per bedroom) = 450 square feet of absorption area required. To obtain the trench length, divide the area required by two times the effective depth of the trench: (450 ft^2) / (2 x 5 ft) = 45 ft.

- For a shallow trench: To determine the total trench length required, divide the required absorption area by the trench width (because the system size is based on the bottom area only). Note that for a shallow trench, the maximum trench width is 5 feet.

For example, a three-bedroom single-family residence with a gravel soil and a chosen trench width of five feet, the calculation would be as follows. Because gravel soils are located in the absorption area, the system requires a sand liner. The soil rating for sand liner material is 125 square feet per bedroom. Sizing calculations would be:

(3 bedrooms)(125 square feet per bedroom) = 375 square feet of absorption area required. To obtain the trench length, divide the absorption area required by the trench width: 375 ft^2 / 5 ft. = 75 ft.

- For a seepage pit: To determine the length of one side, divide the required absorption area by (4 times the chosen effective depth of the pit). The factor "4" is used because the pit uses 4 side walls for absorption. This calculation assumes a pit with four equal sides. For a pit with unequal sides, divide the total required absorption area by the chosen effective depth of the pit, resulting in the total perimeter of the pit (distance around).

For example, a three bedroom single family residence with a percolation test result of 15 minutes per inch and a chosen effective depth of five feet, the calculation would be: Table 7 shows a soil with a percolation rate of 15 minutes per inch is rated at 190 square feet per bedroom. Therefore: (3 bedrooms)(190 square feet per bedroom) = 570 square feet of absorption area required. To obtain the length of one side of a square pit, divide the area required by (the effective depth times 4 sides): 570 ft^2 / (5 ft x 4 sides) = 28.5 feet/side. To obtain the perimeter of a pit with uneven sides, divide the area required by the effective depth: 570 ft^2 / 5 ft =114 ft perimeter.

- For a bed: To determine the bed length required, divide the required absorption area by the bed width. Conversely, to determine the bed width, divide the required absorption area by the bed length.

For example, a small shopping center with 100 parking places and 20 employees and a SP soil.

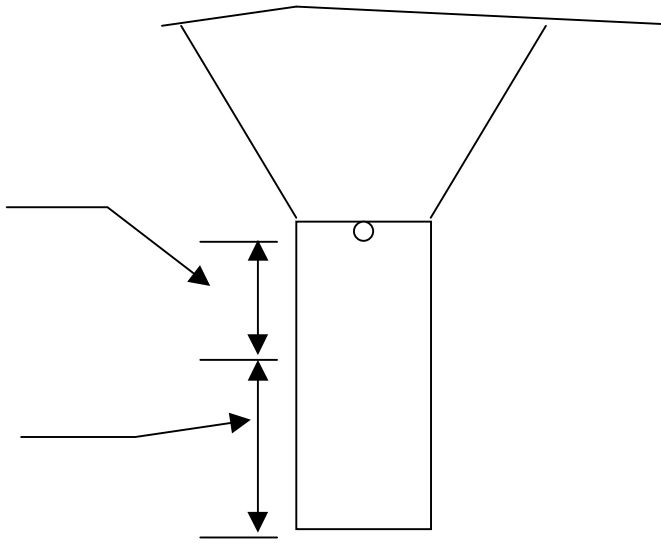
To determine the wastewater design flows, both customers and employees contribute to the total. According to Table 1, each parking space results in 1.1 gallons of wastewater per day and each employee contributes 10.6 gallons per day. The total flow = (100 spaces) (1.1 GPD/space) + (20 employees) (10.6 GPD/employee) = 110 + 212 = 322 gallons of wastewater per day.

From Table 8, a SP soil is rated at 150 square feet per bedroom, which equates to 1 gallon per square foot per day. (A wastewater design flow of 322 gallons per day)/(1 gallon per day per square foot) = 322 square feet of absorption area required. If we choose a bed width of 12 feet, the required bed length is 322 square feet/12 feet = 26.8 feet, say 27 feet minimum.

5. Design Example.

The following example illustrates how to size a system in two different soils.

FIGURE 6: Two Soil, Deep Trench Design Example.



In accordance with Table 8, horizon A, the upper 3' layer of sand, should be rated at 125 square feet per bedroom.

Horizon B, the 4 foot layer of silty sand with a percolation rate of 22 minutes per inch (MPI), should be rated between 190 square feet per bedroom and 250 square feet per bedroom. Based on Table 7, the designer could simply use the 250 square feet per bedroom for horizon B. Alternatively, we could interpolate between the two values of 190 and 250 as follows:

perc rate	soil rating
15	190
22	unknown (218)
30	250

TO CALCULATE THE SOIL RATING FOR OUR SOIL WITH A PERCOLATION RATE OF 22:

THE 22 MPI SOIL IS ABOUT MIDWAY BETWEEN 15 AND 30, BUT SLIGHTLY CLOSER TO 15. SO BY INSPECTION, THE PERCOLATION RATE THAT WE END UP WITH FOR HORIZON B SHOULD BE CLOSER TO 190 THAN 250. THE CALCULATION MAY BE DONE AS FOLLOWS:

[(22-15)/(30-15)](250-190) + 190 = 218 SQUARE FEET PER BEDROOM

By interpolation, the expected soil rating is 218 square feet per bedroom for Horizon B. As a check on our work, 218 is slightly closer to 190 then it is to 250, so our answer is reasonable.

To size the absorption area, we must account for the different soil ratings and the different effective depth in each soil horizon. One way to look at this problem is to determine how much each running foot of trench contributes:

For horizon A: 3' of effective depth X 2 sides = 6 sq. ft. At 125 sq. ft/bedroom 6/125 = 0.048 bedroom/ft

For horizon B: 4' of effective depth X 2 sides = 8 sq. ft. At 218 sq. ft/bedroom 8/218 = 0.037 bedroom/ft

0.048 + 0.037 = 0.085 bedroom/foot of trench.

In other words, each running foot of trench is good for 0.085 bedrooms. If for instance, we have a 3 bedroom home the total length of trench needed in this example is 3 divided by 0.085 = 35.3', say 36' minimum.

X. PUMP STATIONS.

Most septic systems rely on gravity to sustain flow through the system. This requires the septic tank inlet to be lower than the building drain and the absorption area to be lower than the septic tank outlet. Occasionally, site conditions prohibit a gravity flow installation, because either the septic tank or the absorption area must be placed higher than the building drain. In these cases, an appropriate pump must be used to lift the sewage or septic tank effluent to the required elevation.

In cases where the septic tank must be higher than the building drain, a solids handling pump or a grinder pump, located in a pumping chamber (or sump) must be used to handle the solid material in domestic sewage. Sumps may be located in a basement or crawl space or outside the building foundation.

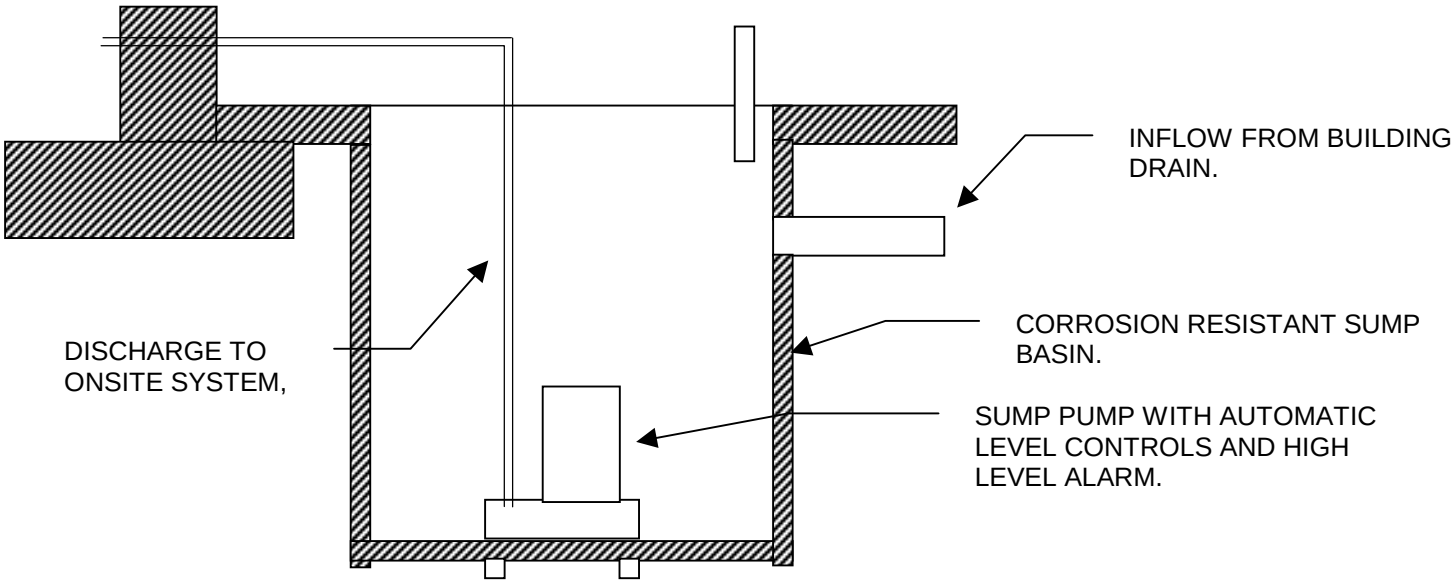
In cases where the absorption area must be higher than the septic tank, an effluent pump is usually employed, because most of the solid material is retained in the septic tank. Effluent pumps may be integrally located in a separate chamber in the septic tank, or may be in a separate pumping chamber located downstream from the septic tank or other acceptable configurations.

Pumping raw or non-clarified sewage should be avoided whenever possible.

A. Basement Sump

When wastewater fixtures are positioned below the building sewer, the sewage must be pumped from the lower elevation to the higher elevation. Most often, a sump is installed in the basement to collect the wastewater and to provide a chamber for the pump. The sump is usually installed at the time of pouring the basement floor so that it can be cast into the floor. The basin should

Figure 7. Basement Sump



be made from corrosion resistant material and have a sealed cover. All connections must be water-tight. Because raw sewage contains large solids, a submersible grinder pump or a properly sized solids handling centrifugal pump, capable of passing 2 inch minimum or larger solids must be used. Grinder pumps have cutting blades that grind solids to a size that will not clog the pump or piping.

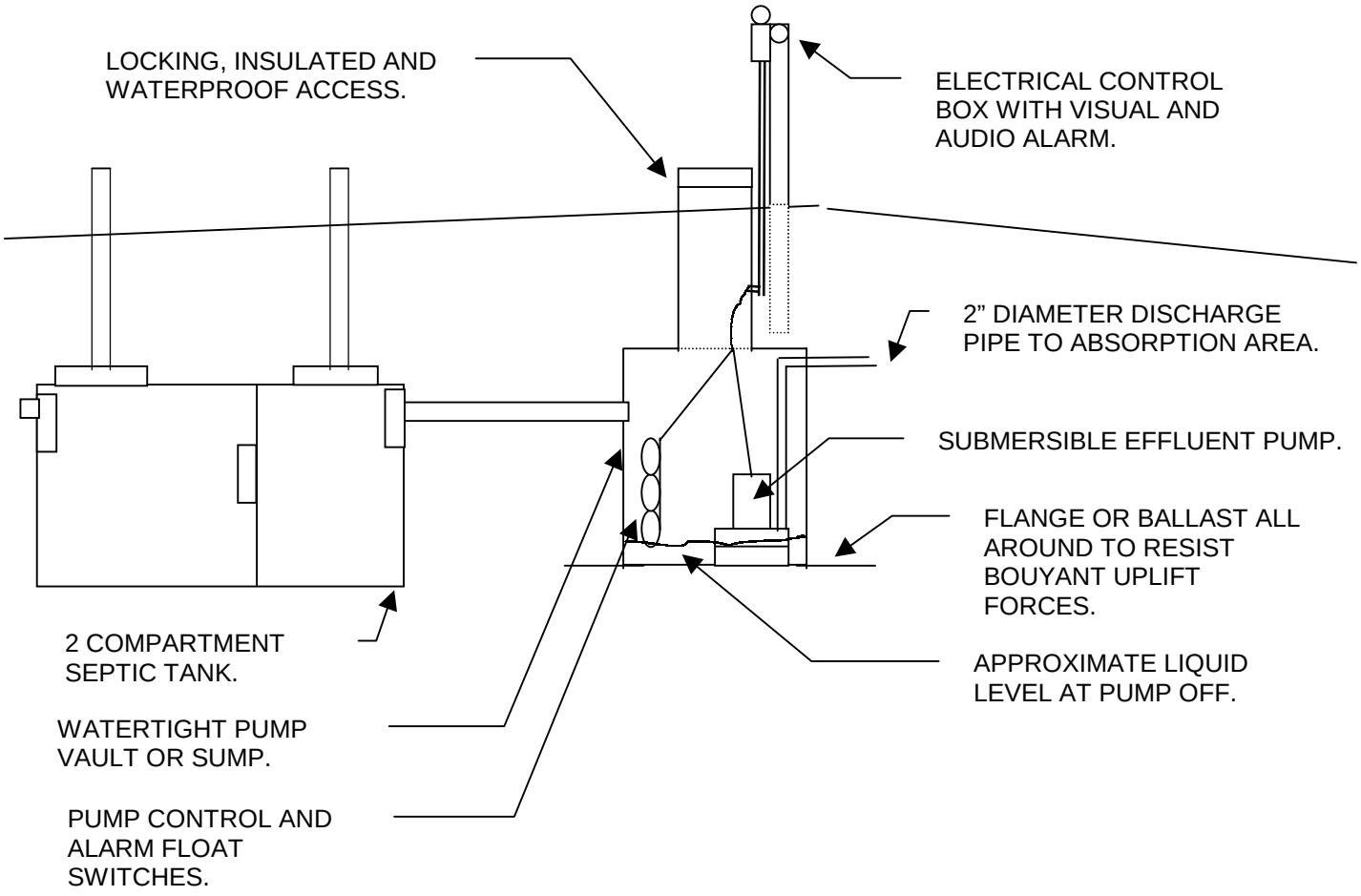
The liquid level in the basin is usually controlled by a float switch that automatically cycles the pump when a pre-set liquid level is reached. Many pump manufacturers offer a complete packaged basin with pump, controls and a high level alarm. A pump must be selected that is capable of meeting the total dynamic head requirements of the system (elevation change, pipe friction loss and energy losses). All pumping systems must conform to the requirements of the Uniform Plumbing Code and contain a high level alarm.

Pumping systems handling raw sewage should be avoided whenever possible, by adjusting the house elevation or the onsite system elevation during the planning stages.

B. Septic Tank Effluent Pumping (STEP)

When the absorption area must be located above the outlet of the septic tank, an appropriately sized pump must be used to lift the effluent from the sump or dosing chamber to the absorption area as shown in Figure 8.

Figure 8. Septic Tank Effluent Pump System



Pumps for septic tank effluent must be capable of handling a limited amount of solids. While most of the solids are retained by the septic tank, some may escape that can clog a non-solids handling pump. The most common type of pump used for this application is the submersible pump (a centrifugal pump or sump pump that is submerged in the effluent).

The pump vault should be sized to provide the volume of discharge desired per pump cycle. The quantity of effluent pumped to the absorption area in each dose must not exceed the capacity of the field.

Some manufacturers offer package pump and sump combinations complete with installed controls and alarms.

Proper pump selection, plumbing and electrical wiring that meets current codes and the use of watertight pump basins, are necessary for a safe and reliable installation. Pumps should be selected according to manufacturer recommendations, considering the quality and quantity of sewage to be pumped AND the elevation and friction heads to be overcome. The pump vault must be watertight and corrosion resistant.

Regardless of the configuration used, the design should provide easy maintenance and long lasting, dependable components. An accessible disconnect fitting should be used on pump discharge piping so that all maintenance can performed without entering the pumping vault. Special attention should be given to the use of corrosion resistant materials.

C. Installation

The basement sump system falls under the jurisdiction of the Department of Labor, the agency responsible for enforcement of the Uniform Plumbing Code (UPC). Typically, plumbing done within the residence must be performed by a licensed plumber and in accordance with the Uniform Plumbing Code. The basement sump must have the same separation distance from a drinking water supply source as a private sewer line as indicated in Table 6 of this manual.

The septic tank effluent pumping (STEP) system can be installed by a Certified Installer or Approved Homeowner, provided that the pump vault is a pre-packaged unit previously approved by ADEC, with the discharge to a conventional (non-pressurized distribution) soil absorption system. An alarm system, with both audible and visual alarms, is required to alert the homeowner in case of system failure.

Special attention should be focused on freeze protection, preventing unwanted access, conformance to the National Electrical Code (NEC), and maintainability of the system.

XI. MINIMUM MATERIAL SPECIFICATIONS

PIPE MATERIALS.

Pipe Type or ASTM Designation	Approved for Drainfield Pipe	Approved for Cleanouts or Standpipes
Cast Iron 4 inch	YES	YES
ASTM D3034 (PVC)	YES	YES
ASTM F789 (PVC)	YES	YES
ASTM D2662 (ABS)	YES	YES
ASTM D2751 (ABS)	YES	NO
ASTM F810 (HDPE)	YES	NO

SAND LINER (FILTER) SPECIFICATIONS

Standard 1 - specific sieve criteria.

- Sand must meet both the sieve criteria in a) and the criteria in b).

a) U.S. Standard Sieve No. | % Passing

#10	85-100
#20	60-90
#40	25-50
#60	less than or equal to 15
#200	less than 5

b) The sand may not have more than 45% (of the total) passing any one sieve and retained on the next consecutive sieve of those shown above.

-OR-

Standard 2 - C_c and C_u Criteria.

a) The Coefficient of Uniformity (C_u) must be less than 4; and

b) The Coefficient of Curvature (C_c) must be equal to or less than 1: and

c) The amount passing the #10 Standard U.S. sieve must be greater than or equal to 85% of the total; and

d) The amount passing the #200 Standard U.S. sieve must be less than 5% of the total; and

(e) The sand may not have more than 45% (of the total) passing any one sieve and retained on the next consecutive sieve of those shown in Standard 1.

General Material Specifications.

Couplings - Caulder, Fernco, or equivalent

Insulation - Dow Chemical Co. Styrofoam HI (Blue Board) or equivalent

Septic tanks - Must meet plumbing code requirements and be watertight.

Wood septic tanks - NOT ACCEPTABLE

Filter Fabric - Typar 3401, Mirafi 140 N, or equivalent

Sewer Rock:

Backfill (screened rock) - 3/4" to 3" screened rock with less than 3% passing #200 sieve residual, unless prior waiver issued due to remoteness, etc.

Sizing (requirements) - 3/4" to 3" for deep trench and pits.
3/4" to 1.5" for bed and shallow trench type systems

XII. MINIMUM CONSTRUCTION REQUIREMENTS

1. Mechanical watertight couplings, such as Caulder coupling, Fernco coupling, or equivalent are required on the inlet, outlet, and cleanout (vent) pipes of septic tanks. Manhole covers must also be watertight.
2. The Wastewater Treatment and Disposal Regulations require that septic tanks have two compartments (18 AAC 72.035(a)).
3. Solid pipe with no joints should span 10 feet from the inlet and outlet of septic tanks onto undisturbed earth.
4. Pressure distribution should be provided on all elevated bed and mound systems. Systems that employ pressure distribution must be designed by a registered Engineer and approved in writing by ADEC prior to construction.
5. A barrier of geotextile filter fabric is always required on top of the sewer rock to prevent soil backfill from migrating into the distribution rock. VISQUEEN or other impermeable material may not be used.
6. One inch of approved insulation may be substituted for one foot of soil cover. If adequate insulation is used, the soil cover depth may be reduced to two feet. Check with local ADEC office on its requirements for existing components. Filter Fabric is still required with insulation.
7. When side walls have smearing (glazing) evident, an alternate strata should be used or a soil test by a professional engineer registered in Alaska can be performed to determine the soils absorption ability.
8. On sloping lots, leach lines should traverse the slope.
9. Avoid compaction of soil strata to be used for absorption.
10. A foundation cleanout is required by the Uniform Plumbing Code.
11. Perforated pipes in the absorption bed, septic tanks, trench, bed, and pit bottoms must be level. Septic tanks and solid piping must be laid on undisturbed or properly compacted soils. Soil in the pipe zone should be compacted to adequately protect the pipe from excessive deflections.
12. A cleanout is required ahead of the septic tank anytime a bend of 45 degrees or more is used.
13. Plat notes on the subdivision plat are recorded legal requirements that apply to installers. Many times these notes were a condition of ADEC subdivision approval.
14. Cesspools are not legal for use as a wastewater treatment and disposal system.

15. When wastewater disposal systems are abandoned, a septic tank and seepage pit must have the sewage removed by a septic tank pumper, and must be crushed in-place or completely filled with compacted soil, concrete, or other approved material, as required by the Uniform Plumbing Code. Depending upon specific site conditions, disinfection may also be required.

16. Excavations should not be left open in order to prevent freeze-up or an unsafe situation.

17. A two-foot thick sand liner meeting ADEC specifications, must be placed beneath all absorption systems when the receiving soil is classified as GW or GP, unless waived by the Department or additional treatment is otherwise provided. Verification that the sand used either meets the ADEC specification or is from an approved source must be submitted to ADEC, with the Documentation of Construction form.

18. Sand liners can only be used on bed or shallow trench type systems unless special, previously approved methods are used. It is recommended that the size of the soil absorption area be increased by 50% to help extend the life of the system.

19. Use of a lift station pump chamber within a septic tank requires the addition of 250 gallons to the minimum septic tank size.

20. Final grading over a wastewater disposal system should be slightly mounded to allow for settling.

21. Monitor tubes are required at the end of each trench and at both ends of a trench if the sewer line intersects the trench such as to make a "tee" connection. At least two monitor tubes are required in opposite corners of all bed type soil absorption system. A monitor tube in each corner is highly recommended.

22. In a multiple trench or bed soil absorption systems, the wastewater must be distributed to each lateral by a solid pipe manifold.

23. Systems must be graded to drain water away from both the septic tank and the absorption area. If backfill has settled, or was not properly completed at the time of construction, the area should be re-graded to provide adequate drainage.

24. Mounds must have a topsoil cap that is at least six inches thick and seeded with at least one pound of grass seed per 250 square feet of area.

25. All plastic pipe joints in monitoring tubes, solid lines, manifolds, and distribution piping must be glued with proper cement.

26. The slope of the sewer line in the 10 feet immediately preceding the septic tank must be between 1/8" to 1/4" per foot (not to exceed 2% slope).

27. The recommended maximum width for beds is 20’.

28. Covers over cribs must be constructed from materials that will not rot or excessively corrode and must be designed to adequately support soil loads determined by depth of cover.

For system upgrades where existing sewer components do not meet current separation distance requirements or minimum material specifications, contact the local ADEC office for a determination of the need for system component replacement.

XIII. REFERENCES

The following references are listed in the wastewater regulations [* - denotes an onsite system reference]:

1. **Alternative Sewer Systems**, Manual of Practice Number FD-12, 1986, Water Pollution Control Federation, 601 Wythe St., Alexandria, VA 22314-1994;

2. **American Water Works Association**, Standard C600-93, Installation of Ductile Iron Water Mains and Their Appurtenances, American Water Works Association, 6666 W. Quincy Ave., Denver, CO 80235;

*3. **Cold Climate Utilities Manual**, Canadian Society for Civil Engineers, 1986, Canadian Society for Civil Engineers, 2050 Mansfield St., Montreal, Quebec H3A 1Z2, Canada (514)842-5653;

4. **Design and Construction of Sanitary and Storm Sewers**, Manual of Practice No. FD-4, 1981, Water Pollution Control Federation, 601 Wythe St., Alexandria, VA 22314-1994;

5. **Design of Wastewater and Stormwater Pumping Stations**, Manual of Practice No. FD-4, 1981, Water Pollution Control Federation, 601 Wythe St., Alexandria, VA 22314-1994;

6. **Environmental Engineering and Sanitation**, Second Edition, Joseph A. Salvato, Jr., 1972, John Wiley & Sons, Inc., New York, NY;

7. **Glossary - Water and Wastewater Control Engineering**. Joint Editorial Board, American Public Health Association, American Society of Civil Engineers, American Water Works Association, and Water Pollution Control Federation, Third Edition, 1981, Water Pollution Control Federation, 601 Wythe St., Alexandria, VA 22314-1994;

8. **Gravity Sanitary Sewer Design and Construction**, Manual of Practice No. FD-5, 1982, Water Pollution Control Federation, 601 Wythe St., Alexandria, VA 22314-1994 (American Society of Civil Engineers Manuals and Reports on Engineering Practice No. 60);

9. **High Rate Soil Absorption (HRSA) Task Force, Recommendations on Key Management Issues**, Minnesota Pollution Control Agency, 520 Lafayette Rd. North, St. Paul, MN 55155;

10. **Mixing in Inland and Coastal Waters**, H.B. Fischer, E.J. List, R.C.Y. Koh, J. Imberger, N.H. Brooks, 1979, Academic Press Inc., 111 Fifth Avenue, New York, NY 10003;

*11. **Onsite Wastewater Treatment, Proceedings of the Fourth National symposium on Individual and Small Community Sewage System**, "Estimating Ground-water Quality Impacts from Onsite Sewage Treatment Systems", B.J. Bauman and W.M. Schafer, 1985, American Society of Agriculture Engineers, 2950 Niles Road, St. Joseph, MI 49085-9659;

*12. **Onsite Wastewater Treatment and Disposal Systems (Design Manual)**, EPA 625/1-80-012, 1980, U.S. Environmental Protection Agency, Office of Research and Development, Technology Transfer, Cincinnati, OH 45268;

13. **Recommended Standards for Sewage Works**, Great Lakes - Upper Mississippi River Board of State Sanitary Engineers, 1978, Health Education Service, Inc., P.O. Box 7126, Albany, NY 12224;

14. **Septic Tank System Effects on Ground Water Quality**, 1985, Larry W. Canter, and Robert C. Knox, Lewis Publishers, Inc., 121 South Main Street, Chelsea, MI 48118;

*15. **A 1979 State of the Art Manual of Onsite Wastewater Management**, 1979, The National Environmental Health Association, 1200 Lincoln St., Suite 704, Denver, CO 80203;

*16. "The Use of the Unified Soil Classification System by the Bureau of Reclamation", A.A. Wagner, in Proceedings of the 4th International Conference on Soil Mechanics and Foundation Engineering, London, Vol 1, 1957; also cited in Handbook of Environmental Civil Engineering, Robert G. Zilly, ed., 19756, p. 91, Van Nostrand Reinhold Co., 450 West 33rd Street, New York, NY 10001;

*17. **Uniform Plumbing Code**, 1997 edition, Appendix K, International Association of Plumbing and Mechanical Officials, 5032 Alhambra Avenue, Los Angeles, CA 90032;

18. **Wastewater Engineering; Collection, Treatment, Disposal, Reuse,** Second Edition, Metcalf & Eddy, Inc., revised by George Tchobanoglous, 1979, McGraw-Hill Book Company, 148 Princeton-Hightstown Rd., Hightstown, NJ 08520-1450;

Additional References for Onsite Wastewater Treatment & Disposal

Bowne, W.C., “Septic Tank Effluent Pumps and Controls" in Proceeding of the Fourth Northwest Onsite Wastewater Disposal Short Course. University of Washington, 1982.

Mellen, W.L., Septic System; The How's and Why's, 1981. Lake County Health Department, Waukegan, IL.